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MEMORANDUM

To: Mr. Kent Morgan

From: Patrick Siegman

Date: February 1, 2005

Subject: On-Street Bike Lanes Preferred Alternative

This memo describes the preferred Downtown Bicycle Facilities Plan for Lincoln's Downtown Master Plan, and is intended to supplement the plans and sections of the bikeway system included elsewhere in the Downtown Master Plan. The alternative chosen for the on-street bicycle lanes proposes the use of back-in/head-out angle parking: a separate brief report (See Attachment 1) describes the benefits of this approach to parking and design issues in implementing this type of parking, and provides examples of numerous installations around the country.

The alternatives described herein are based in part upon the results of the first two public workshops, which showed a strong preference for the "local street" option for the on-street bike lane system. The alternatives have also been informed by our conversations and meetings with City Staff from several departments and numerous stakeholders from the downtown community, including business leaders, bicycle and pedestrian advocates, and residents. The recommendations are also informed by our own experience and experience in the design of streets and bikeways, and are intended to provide a bicycle framework that serves as a coordinated, coherent part of the overall Downtown Master Plan, rather than an isolated element.

On-Street Bicycle Lanes

The on-street bicycle network calls for bicycle lanes to be implemented along 11th, 12th, M and N streets, providing a North-South and East-West couplet (See Attachment Y). All proposed bicycle lanes will fit within the existing curblines. There are, however, some issues that need to be addressed:

- Should one have parallel parking or back-in/head-out angle parking along the streets with bicycle lanes?

- Should the bicycle lanes be on the right- or left-hand side of the street?
- How can one increase safety for bicyclists making left-turns at intersections?

Back-in/Head-out Angle Parking or Parallel Parking
For each street, two alternatives were considered: one with back-in/head-out angle parking on both sides of the street (by removing an excess traffic lane); one with parallel parking next to the bike lane (which usually causes some loss of parking spaces).

As the preferred alternative on all streets, we recommend back-in/head-out angle parking on both sides of most blocks (the exception is a few unusual blocks, which are narrower, as shown in the bicycle lane plans for the preferred alternative). This removes an excess traffic lane on most blocks. There are several reasons for this recommendation:

- ***Parking is gained, rather than lost.*** On several blocks, where angle parking exists currently on only one side of the street, the preferred alternative results in a net gain of spaces when an excess travel lane is converted to angle parking with bicycle lane. There are currently some 800 parking spaces along M Street (7th Street to 17th Street), N Street (7th Street to 17th Street), 11th Street (Q Street to Lincoln Street) and 12th Street (R Street to Lincoln Street). With the preferred alternative plan a net gain of approximately 340 parking spaces results within the same blocks.
- ***Fewer vehicle lanes result in slower traffic and simpler maneuvering.*** As described under criteria, fewer vehicle lanes on a street generally reduce motor vehicle speeds, reduce the difficulty and complexity of turning maneuvers for cyclists, and reduce crossing distances for cyclists and pedestrians on cross streets.
- ***Equal or better safety.*** Detailed safety comparisons of placing back-in/head-out angle parking versus parallel parking, when designing parking adjacent to bicycle lanes, have not to our knowledge been made in the research literature. However, as described in the attached report on back-in/head-out, the experience for cyclists and others with back-in/head-out angle parking has been positive. Several factors also lead us to believe that the back-in angle parking will prove to be superior. Unwary cyclists riding next to parallel parked cars are often "doored" (hit by opening car doors), a danger that is obviated with back-in angle parking; exiting motorists from angle parking stalls have excellent visibility of cyclists, rather than backing blindly into an active traffic lane; and the removal of an excess vehicle lane, as described above, aids safety in several regards.

Bicycle Lane on Right- or Left-Hand Side of the Street
Bicycle lanes are usually placed on the right-hand side of the street (from the driver's perspective), since it is the traditional "slow lane" side. There are other reasons to keep the bicycle lane on this side of the street:

- It is more common to expect a bicyclist on the right-hand side. When entering or exiting a garage, alley etc. the car driver is therefore more alert to the possibility of an on-coming cyclist.
- It is easier for the bicyclist to move from a one-way street to a two-way street if the bicycle lane is on the right-hand side. Otherwise the cyclist has to merge from the left-hand side bicycle lane to the right before the intersection to be able to continue on the bicycle lane on the connecting two-way street.

There has been discussion of using the left-hand side of the street on two streets:

- **11th Street**: the bicycle lane could be placed on the left-hand side to minimize conflicts with frequent bus traffic (on some blocks) using the right-hand lane. However, the left-hand side presents equally difficult conflicts with several parking garage entrances. The existing transit system may also be rerouted within 2-3 years, which will result in less bus traffic along 11th Street (a suggestion is to remove the current downtown loop and connect all bus routes on Q Street). Given all of these considerations, our judgment is that the bike lane should be on the right-hand side.
- **M Street:** the bicycle lane could be positioned on the left-hand side to place it adjacent to a proposed park along a few blocks. However, there are also parking garage entrances and exits on the left-hand side of the street, which supports the alternative of having the bike lane on the right-hand side.

For detailed schematic design and preparation of construction documents for the bicycle lanes, we recommend the use of the *VTA Bicycle Technical Guidelines: A Guide For Local Agencies In The Planning, Design And Maintenance Of Bicycle Facilities*[1] as a supplement to the AASHTO *Guide for the Development of Bicycle Facilities*.

Advanced Stop Line (ASL)/Bicycle Box

In intersections where the bicyclist may turn left we propose that an advanced stop line (ASL), also called a bicycle box, is used. Its purpose is to help the cyclist get in front of traffic at signalized intersections. Hence, the bicyclist does not need to merge with traffic to go from the bicycle lane on the right-hand side to the left-hand side of the road. Instead, the bicyclist continues to ride in the bicycle lane and then pulls up in front of the cars right before the intersection during the red-signal phase. Bicycle boxes are not meant to be used when the signal is green. For more information, see the excerpt from the Institute of Transportation Engineers (2002)[2] in Attachment 2.

[1] Santa Clara Valley Transportation Authority, September 1999.
http://www.vta.org/news/vtacmp/Bikes/Bike%20Tech%20Guidelines.pdf

[2] Nabti, J.M. (2002) Innovative bicycle treatments : an informational report of the Institute of Transportation Engineers (ITE) and the ITE Pedestrian and Bicycle Council.

ATTACHMENT 1

NELSON\NYGAARD CONSULTING ASSOCIATES (2005) BACK-IN/HEAD-OUT ANGLE PARKING.

Back-in/Head-out Angle Parking

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Introduction

In recent years the use of back-in/head-out angle parking has increased steadily in cities across North America. There are several reasons for this development. Kulash and Lockwood (2003) state that:

"Back-in/head-out diagonal parking is superior to conventional head-in/back-out diagonal parking. Both types of diagonal parking have common dimensions, but the back-in/head-out is superior for safety reasons due to better visibility when leaving. This is particularly important on busy streets or where drivers find their views blocked by large vehicles, tinted windows, etc., in adjacent vehicles in the case of head-in/back-out angled parking. In other words, drivers do not back blindly into an active traffic lane. The back-in maneuver is simpler than a parallel parking maneuver. Furthermore, with back-in/head-out parking, the open doors of the vehicle block pedestrian access to the travel lane and guide pedestrians to the sidewalk, which is a safety benefit, particularly for children. Further, back-in/head-out parking puts most cargo loading (into trunks, tailgates) on the curb, rather than in the street."

The growing presence on American streets of sport utility vehicles (SUVs), with their bulky rear ends and (frequently) tinted windows may have spurred the trend toward back-in/head-out angle parking: when using conventional angle parking, drivers increasingly find themselves beside an SUV, with more difficult sightlines.

This report briefly discusses the design and benefits of back-in/head-out angle parking and shows where the design has already been implemented.

Some examples

In Tucson, AZ, two blocks of reverse diagonal parking have been installed along the University Boulevard Bikeway (see Figure 1), which leads into the west entrance of the University of Arizona (~36,000 students). In the two years of reverse diagonal parking, there have been no accidents along the segment, despite the large number of cyclists using the bikeway.

Figures 2-4 illustrate some of the benefits of back-in/head-out angle parking. In Figure 2 the driver is able access her trunk from the curb rather than from the street. Figures 3 and 4 show that the driver can have eye contact with oncoming traffic, in this case a bicyclist.

Figure 5 shows typical signage used to introduce drivers to back-in/head-out angle parking. For more examples on back-in/head-out angle parking, see Appendices A and B.

Figure 1 Back-in/Head-out parking in Tucson, AZ.

Source: T. Boulanger, Transportation Services, City of Vancouver, WA.

Figure 2 With back-in angle parking you can load your car on the curb, rather than in the street (Vancouver, WA).

Source: T. Boulanger, Transportation Services, City of Vancouver, WA.

Figure 3 **An 'eye-to-eye' line of sight between parker and approaching road-user (Vancouver, WA).**

Source: T. Boulanger, Transportation Services, City of Vancouver, WA.

Figure 4 **The parker's view of the on-coming traffic (Vancouver, WA).**

Source: T. Boulanger, Transportation Services, City of Vancouver, WA.

Figure 5 A traffic sign showing the three steps of back-in angle parking, in Kelowna, BC, Canada.

Source: City of Kelowna, British Columbia, Canada.

Advantages

Back-in/head-out angle parking is similar to both parallel and standard angle parking. As with parallel parking, the driver enters the stall by stopping and backing, but need not maneuver the front of the vehicle against the curb. When leaving the stall, the driver can simply pull out of the stall, and has a better view of the oncoming traffic.

Bicyclists

This type of parking provides a safer environment for bicyclists using the roadways. The driver is able to see the cyclist easily when exiting the stall. Several cities where back-in angle parking has been implemented have seen a reduction in number of accidents compared to the number of accidents at regular parallel parking schemes. Matt Zoll at

Tucson-Pima County Bicycle Advisory Committee says that after implementing the back-in/head-out angle parking scheme in Tucson they "went from an average of 3-4 bike/car accidents per month to no reported accidents for 4 years following implementation."

Visibility

In contrast to standard angle parking the visibility while exiting a back-in/head-out angle parking into traffic is much improved. When the driver is backing up (into the stall), the driver is in control of his lane: traffic behind either waits, or changes lanes.

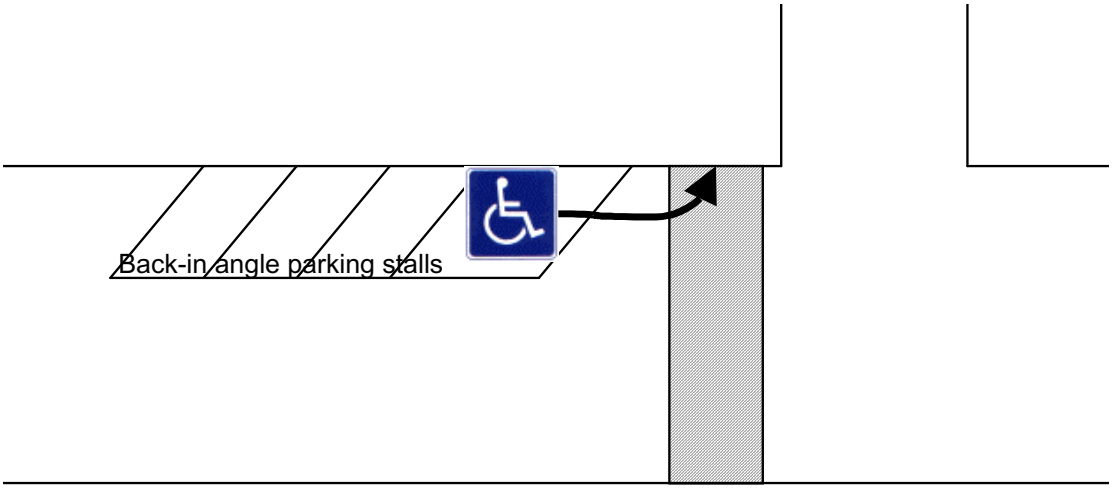
Steep terrain

Back-in angle parking can also be useful on steep terrain: if used on the correct side of the street, it causes drivers to automatically curb their wheels, which in turn prevents runaway autos. Used on the wrong side of a steep street, however, it is likely to cause more runaways.

Disabled parking

In Pottstown, PE, a 13-foot wide handicap accessible stall has been incorporated into the angle parking as the last space, intersection nearside, of each block. This places each disabled parking stall close to the existing curb ramps, and allows the wheelchair-using drivers to unload out of the way of traffic (see Figure 6). By contrast, the street's previous parallel parking arrangement could not be safely used for disabled parking, and conventional angle parking raised safety concerns for the street's proposed bicycle lanes.

Figure 6 A disabled parking stall located right next to the pedestrian crossing and the curb ramp.



Safety

As SLCTrans (2004) states, "one of the most common causes of accidents is people backing out of standard angled parking without being able to see on-coming traffic. Reverse angled parking removes this difficulty." It also improves safety for cyclists, and for loading/and unloading the trunk of the car. Similarly, the *Urban Transportation Monitor*'s recent article on back-in angle parking reported reduced accidents and benefits for bicyclists in several communities. In all, back-in/head-out angle parking is a good choice when compared to conventional head-in angle/back-out parking and parallel parking.

Cities using back-in/head-out angle parking

The list of cities in North America that use back-in/head-out angle parking is growing. Figure 7 lists some of these communities.

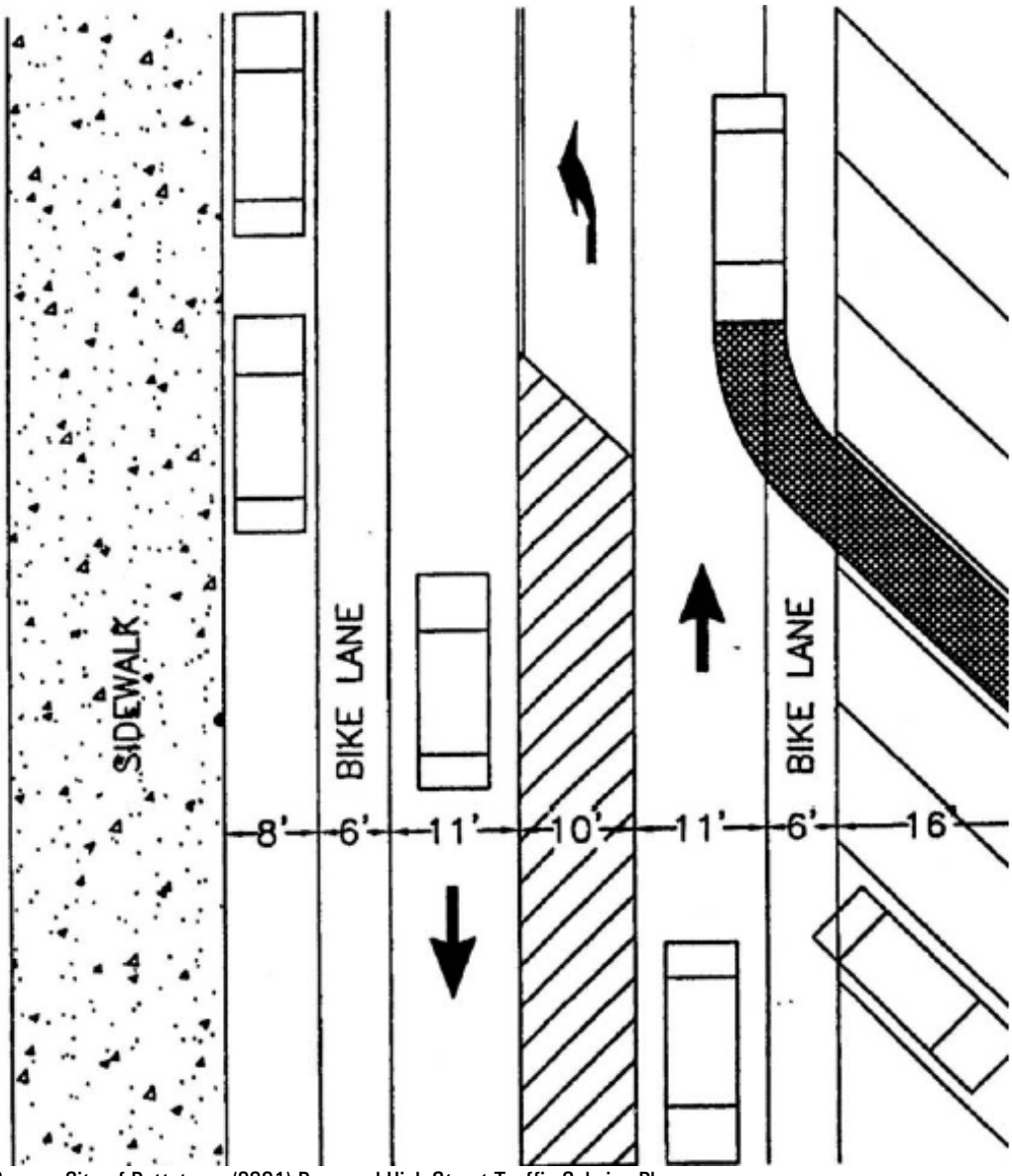
Figure 7 Cities using back-in/head-out angle parking.

City	Source	
Arlington, VI	Dan Burden	Walkable Communities, Inc.
Birmingham, AL	Russ Soyring	City of Traverse City, MI
Burnaby, Canada	Dan Burden	Walkable Communities, Inc.
Charlotte, NC	Dan Burden	Walkable Communities, Inc.
Chico, CA	Patrick Siegman	Nelson\Nygaard
Everett, WA	Michael M. Moule	Livable Streets, Inc
Honolulu, HI	Dan Burden	Walkable Communities, Inc.
Indianapolis, IN	Michael M. Moule	Livable Streets, Inc
Knoxville, TN	Michael M. Moule	Livable Streets, Inc
Marquette, MI	Russ Soyring	City of Traverse City, MI
Montreal, Canada	Michael M. Moule	Livable Streets, Inc
New York, NY	Dan Burden	Walkable Communities, Inc.
Olympia, WA	Dan Burden	Walkable Communities, Inc.
Plattsburgh, NY	Dan Burden	Walkable Communities, Inc.
Portland, OR	Michael M. Moule	Livable Streets, Inc
Pottstown, PA	Michael M. Moule	Livable Streets, Inc
Salem, OR	Todd Boulanger	City of Vancouver, WA
Salt Lake City, UT	Dan Burden	Walkable Communities, Inc.
San Francisco, CA	Michael M. Moule	Livable Streets, Inc
Seattle, WA	Dan Burden	Walkable Communities, Inc.
Tacoma, WA	Dan Burden	Walkable Communities, Inc.
Tucson, AZ	Michael M. Moule	Livable Streets, Inc
Vancouver, WA	Todd Boulanger	City of Vancouver, WA
Ventura, CA	Todd Boulanger	City of Vancouver, WA
Washington, DC	Dan Burden	Walkable Communities, Inc.
Wilmington, DE	Michael M. Moule	Livable Streets, Inc

Typical dimensions

Particularly when accommodating bike lanes within the roadway, back-in/head-out angle parking is useful. Figure 8 shows the cross-section of such a roadway in Pottstown, PA. Appendix C and D shows Vancouver's, WA, and Seattle's, WA, choices of dimensions for this type of parking.

Figure 8 Cross-section of a roadway accommodating both bike lanes and back-in/head-out angle parking.



Source: City of Pottstown (2001) Proposed High Street Traffic Calming Plan.

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City of Pottstown (2004) Back In Angle as a Way to Improve Pedestrian Circulation in the Central Business District High Street, Pottstown Borough, Montgomery County, Pennsylvania, USA.

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SLCTrans, Salt Lake City, UT (2004) Back-in or Reverse Angle Parking - FAQ. http://www.slcgov.com/transportation/Aboutus/FAQ.htm.

Urban Transportation Monitor. Back-in Angle Parking. June 11, 2004, page 1.